

Eight Points on One Page to Help Prevent Lokasil Bore Scoring¹

By Ed Fisher, BSME

“Piston scoring takes place...after a very small rise in oil temperature at the cylinder wall lowers the viscosity so much it cannot support the gap between the piston and the bores, and the increase in friction sets off a vicious circle of events that in a few seconds destroys the surface of the piston and cylinder bore.” –

Hartech Engine Guide, 2012

1. Your cold-start procedure is critical.² Do not warm the car by idling. Start the care and drive away.³ No high revs and no high loads until the crankcase is fully warm. In cold weather this requires 15 to 30 minutes of driving, no matter what the oil temp gauge says.⁴
2. If you take short trips, regularly throw in a longer trip to drive water and gas from the oil.
3. Don't let the car sit for long periods to reduce oil drain from bank 2 thrust faces.⁵
4. Don't use 0W⁶ oil. It's too “thin.” Use a 5W.
5. Change the oil at 6 months or 5,000 miles, whichever comes first, to remove contaminants and limit viscosity breakdown.
6. If you track the car, always change the oil before and after the track day. Never run an M96 or M97 engine with viscosity-damaged oil.⁷
7. Always use a high-quality synthetic oil that better resists viscosity breakdown.
8. Install a 160F thermostat at the first water pump replacement at 40K miles, if not earlier.⁸

¹ These eight points are personal conclusions based on my research of Lokasil 1 & 2 engines, i.e., ~1999 to ~2008 US M96 & M97 engines plus first-gen Cayenne non-turbo engines. The common theme is to assure a supporting oil film between the piston skirt and the cylinder wall. The film is primarily dependent upon viscosity (which changes with temperature), amount and the gap geometry. The first use of Lokasil 1 is unknown but is assumed to be the 1999 3.4L M96 engine. The first use of Lokasil 2 (larger silicon particles) is also unclear but is assumed to be 2005 M97 engines. Lokasil 2 engines clearly have more bore scoring issues.

² High rates of bore scoring were first seen in cold-weather climate engines per Jake Raby.

³ To limit duration of cold-start enrichment which can dilute the cylinder wall oil with gasoline.

⁴ Instrumented tests have shown that the block needs additional time after the oil is warm to assure the cylinders are fully expanded and thus maintain a sufficient piston/wall gap.

⁵ The piston thrust face is on the high side of the cylinders in bank 2 but the oil squirter is aimed at the lower face. In bank 1 the thrust face is low (where the oil wants to gather) and so is the squirter. The majority of bore scoring cases occur in, or begin at, cylinder 6 of bank 2.

⁶ 0W oils were developed to increase gas mileage by reducing pumping and other internal losses, not to prolong the life of engines. 0W-40 oil, for instance, has lower viscosity than 5W-40 oil at the same operating temperature.

⁷ Oils lose viscosity with use, mostly due to shearing effects within the engine, and with increasing temperature.

⁸ 160F was the standard prior to modern environmental concerns. 40k miles is the composite-bladed water pump replacement interval per many experts. The std t-stat begins to open at 187F. By opening the t-stat earlier (and keeping it open) temperatures among the cylinders equalize earlier and continue to run cooler, increasing thermal margin at the cylinder wall, especially after a M96 head gasket feature that promoted equal coolant flow to all cylinders was eliminated in the M97, reducing coolant flow to cylinder 6.